Changes in Stratigraphic Nomenclature by the U.S. Geological Survey, 1970

GEOLOGICAL SURVEY BULLETIN 1354-A

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By GEORGE V. COHEE, ROBERT G. BATES, *and* WILNA B. WRIGHT

CONTRIBUTIONS TO STRATIGRAPHY

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CHANGES IN STRATIGRAPHIC NOMENCLATURE BY THE U.S. GEOLOGICAL SURVEY, 1970

By GEORGE V. COHEE, ROBERT G. BATES, and WILNA B. WRIGHT

LISTING OF NOMENCLATURAL CHANGES

In the following table, stratigraphic names adopted, revised, reinstated, or abandoned are listed alphabetically. The age of the unit, the revision, and the area involved, along with the author's name and date of publication of the report, are given. The publications in which the changes in nomenclature were made are listed in the references at the end of this publication. The capitalization of age terms in the age column follows official usage.

Name	Age	Location
Akalura Glaciation or Drift.	Pleistocene	Alaska
Albee Formation	Middle Ordovician	Vermont and New Hampshire.
Albion Range Group	Precambrian(?)	Utah
Allen Ridge Formation (of Mesaverde Group).	Late Cretaceous	South-central Wyoming.
Almond Formation (of Mesaverde Group).	Late Cretaceous	Southwestern Wyoming.
American Flag Formation.	Late Cretaceous	Arizona
Andrew Lake Formation	middle or late Eocene	Southwestern Alaska
Angelo Member (of Green River Formation).	Eocene	Southwestern Wyoming.
Animikie Series	middle Precambrian	Northern Michigan and northern Wisconsin.
Ashlock Formation	Late Ordovician	Central Kentucky
Bakers Bridge Granite	Precambrian	Southwestern Colorado
Baraga Group	middle Precambrian	Northern Michigan and northern Wisconsin.
Barstow Formation	late Miocene	Southern California
Bashi Marl Member (of Hatchetigbee Formation of Wilcox Group).	Eocene	Mississippi
Baxter Springs Member (of Boone Formation).	Late Mississippian	Oklahoma and Kansas
Beidell Quartz Latite	Oligocene	Southwestern Colorado
Belden Formation	Early (Morrow) and Middle (Atoka) Pennsylvanian.	Colorado
Belt Supergroup	Precambrian	Idaho
Ben Hur Limestone	Middle Ordovician	Eastern Tennessee
Bethlehem Gneiss	Early(?) Devonian	New Hampshire
Bickford Granite	Middle(?) and Late(?) Devonian.	New Hampshire
Big Basin Sandstone	Permian	Southwestern Kansas
Bingham Mine Formation.	Late Pennsylvanian (Missouri and Virgil).	North-central Utah
Bingham Quartzite	Pennsylvanian	North-central Utah
Boehls Butte Formation (of Belt Supergroup).	Precambrian	Idaho
Bonanza Latite	Oligocene	Southwestern Colorado
Boone Formation	Early and Late Mississippian.	Oklahoma and Kansas

Revision and reference
Akalura Glaciation or Drift adopted. (Karlstrom, 1969.)
Age changed from Ordovician to Middle Ordovician. (Cady, 1969.)
Albion Range Group extended into Curlew Valley, northwestern Utah. (Bolke and Price, 1969.)
Allen Ridge Formation of Bergstrom (1959) adopted in Hanna and Carbon basins. Overlies Haystack Mountains Formation (new); unconformably underlies Pine Ridge Sandstone. (Gill and others, 1970.)
Almond Formation extended into south-central Wyoming. (Gill and others, 1970.)
Age changed from Cretaceous(?) to Late Cretaceous. (Hayes, 1970a.)
Andrew Lake Formation adopted. (Scholl and others, 1970.)
Angelo Member adopted. (Oriel and Tracey, 1970.)
Animikie Series abandoned in northern Michigan and northern Wisconsin; replaced by Marquette Range Supergroup. Animikie Group remains in good usage in northern Minnesota. (Cannon and Gair, 1970.)
Tate member of Ashlock Formation in central Kentucky extended into northeastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
Bakers Bridge Granite adopted. (Barker, 1969.)
Baraga Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
Age changed from middle and late Miocene to late Miocene. (Lewis, 1968.)
Bashi Marl Member of Hatchetigbee Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
Baxter Springs Member adopted. (McKnight and Fischer, 1970.)
Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)
Age changed from Pennsylvanian to Early (Morrow) and Middle (Atoka) Pennsylvanian. (Mutschler, 1970.)
Includes Boehls Butte Formation in report area. (Hietanen, 1968.)
Ben Hur Limestone changed to Ben Hur Formation in this quadrangle. (Harris and Mixon, 1970.)
Age changed from Late Devonian(?) to Early(?) Devonian. (Cady, 1969.)
Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
Big Basin Sandstone of Cragin (1896) adopted. (Meyer and others, 1970.)
Bingham Mine Formation of Welsh and James (1961) adopted as uppermost of three formations in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Includes (in ascending order): Clipper Ridge and Markham Peak Members (both new). Overlies Butterfield Peak Formation (new). (Tooker and Roberts, 1970.)
Bingham Quartzite abandoned. Rocks at its type locality reassigned to part of Oquirrh Group. (Tooker and Roberts, 1970.)
Boehls Butte Formation adopted. Includes units formerly considered lowest exposed part of Prichard Formation in Boehls Butte area. (Hietanen, 1968.)
Age changed from Tertiary to Oligocene. (Lipman and others, 1970.)
Boone Formation in Picher field area divided into the following members (in ascending order): St. Joe Limestone, Reeds Spring, Grand Falls, Joplin (new), Short Creek, Baxter Springs (new), and Moccasin Bend. (McKnight and Fischer, 1970.)

Name	Age	Location
Borden Formation	Early and Late Mississippian.	Kentucky
Brezee Phyllite	Early Cambrian	Vermont
Bright Angel Shale	Early and Middle Cambrian.	Southeastern California and southern Nevada.
Brimfield Schist	Middle(?) Ordovician or older.	Connecticut
Browns Canyon Formation.	Miocene	Colorado
Browns Park Formation	Miocene and Pliocene (?).	Utah, Colorado, and Wyoming.
Buckhorn Conglomerate Member (of Cedar Mountain Formation).	Early Cretaceous	Utah and Colorado
Buffalo Wallow Formation.	Late Mississippian	Kentucky
Bug Formation	Pliocene or Pleistocene	Wyoming
Bulldog Hollow Member (of Fowkes Formation).	Eocene	Southwestern Wyoming.
Bull Fork Formation	Late Ordovician	Northeastern Kentucky
Bullpen Member (of Wasatch Formation).	Eocene	Southwestern Wyoming.
Butterfield Limestone Member (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Butterfield Peaks Formation.	Middle Pennsylvanian	North-central Utah
Caballo Blanco Rhyolite Tuff Member (of Datil Formation).	Oligocene	Southwestern New Mexico.
Catoctin Formation	Precambrian	West Virginia, Virginia, Pennsylvania, and Maryland.
Cedar Mountain Formation.	Early Cretaceous	Utah and Colorado
Chiapuk Rhyolite	Late Cretaceous	Arizona
Chocolay Group	middle Precambrian	Northern Minnesota and northern Wisconsin.
Cinnamon Ridge Member (of Flat Ridge Formation).	Precambrian	North Carolina, Virginia, and Tennessee.
Circle Volcanics	upper Paleozoic	East-central Alaska
Clarno Formation	Eocene and early Oligocene.	Oregon
Clipper Ridge Member (of Bingham Mine Formation).	Late Pennsylvanian	North-central Utah

Revision and reference
Farmers Siltstone Member of New Providence Formation of Stockdale (1939) redefined and adopted as Farmers Member of Borden Formation. Includes Henley Bed at base. (Peck, 1969.)
Name changed from Brezee Phyllite to Brezee Formation. (Cady, 1969.)
Age changed from Middle Cambrian to Early and Middle Cambrian in southern Nevada and southeastern California; age remains Middle Cambrian in Arizona. (Stewart, 1970.)
Daly Swamp Member (new) of Brimfield Schist adopted. (Snyder, 1970.)
Browns Canyon Formation adopted. (Van Alstine, 1969.)
Age changed from Miocene(?) to Miocene and Pliocene(?). (Izett and others, 1970.)
Buckhorn Conglomerate of Stokes (1944) adopted as Buckhorn Conglomerate Member of Cedar Mountain Formation. (Cullins, 1969.)
In north-central Kentucky, Buffalo Wallow Formation includes following members (in ascending order): Vienna Limestone, Waltersburg, Menard Limestone, unnamed unit (includes equivalents of Degonia Sandstone, Clore Limestone, and Palestine Sandstone), and Kinkaid Limestone. (Goudarzi, 1970.)
Bug Formation adopted. (Love, 1970.)
Bulldog Hollow adopted as middle member. Overlies Sillem Member (new); underlies Gooseberry Member (new). (Oriel and Tracey, 1970.)
Sunset Member of Arnheim Formation of Foerste (1912) adopted as Sunset Member of Bull Fork Formation. (Outerbridge, 1970.)
Bullpen Member adopted. (Oriel and Tracey, 1970.)
Butterfield Limestone Member abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
Butterfield Peaks Formation adopted as middle formation of three in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Overlies West Canyon Limestone; underlies Bingham Mine Formation. (Tooker and Roberts, 1970.)
Caballo Blanco Rhyolite Tuff of Elston (1957) adopted as member of Datil Formation. (Ericksen and others, 1970.)
Age changed from late Precambrian(?) to Precambrian. (Espenshade, 1970.)
Cedar Mountain Formation divided into Buckhorn Conglomerate Member and overlying unnamed shale member. (Cullins, 1969.)
Age changed from late(?) Mesozoic to Late Cretaceous. (Hayes, 1970a.)
Chocolay Group removed from Animikie Series (abandoned); placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
Cinnamon Ridge Member abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)
Age changed from Early Mississippian to late Paleozoic. (Brabb and Churkin, 1969.)
Age changed from Eocene to Eocene and early Oligocene. (Swanson, 1969.)
Clipper Ridge Member adopted as basal member. Recognized in Bingham sequence (central and southern Oquirrh Mountains). Underlies Markham Peak Member (new). (Tooker and Roberts, 1970.)

Name	Age	Location
Cloudburst Formation	Late Cretaceous	Arizona
Cocoraque Formation	Early Cretaceous	Arizona
Cody Shale	Late Cretaceous	Central Wyoming
Commercial Limestone Member (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Concepción Formation	Eocene	Northwestern Puerto Rico.
Concord Granite	Middle(?) and Late(?) Devonian.	New Hampshire
Conejos Formation	Oligocene and older(?)	Southwestern Colorado
Copper Basin Formation	Early Mississippian to Late Pennsylvanian.	South-central Idaho
Corkscrew Quartzite	Early Cambrian	Nevada and California
Cornett Basalt Member (of Flat Ridge Formation).	Precambrian	North Carolina, Virginia, and Tennessee.
Coronados Volcanics	Middle Devonian	Southeastern Alaska
Crooks Gap Conglomerate.	Eocene	Wyoming
Dad Sandstone Member (of Lewis Shale).	Late Cretaceous	Wyoming
Daly Swamp Member (of Brimfield Schist).	Middle(?) Ordovician or older.	Connecticut
Datil Formation	Oligocene	New Mexico
Daylight Formation	Precambrian and Early Cambrian.	Nevada and California
Decie Ranch Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas
Descon Formation	Early Ordovician and Early Silurian.	Southeastern Alaska
Deseret Limestone	Late Mississippian	Utah
Dry Union Formation	Miocene and Pliocene	Colorado
Dugout Mountain Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas
Dutton Creek Formation	Paleocene	Wyoming
Echooka Member (of Sadlerochit Formation).	Late Permian	Northern Alaska
Echooka River Glaciation).	Pleistocene	Northern Alaska
El Capitan Granite	Late Jurassic	Eastern California
Electra Lake Gabbro	Precambrian	Southwestern Colorado
Elk River Beds	Pliocene or Pleistocene	Southwestern Oregon

Revision and reference
Age changed from Late(?) Cretaceous or early Tertiary to Late Cretaceous. (Hayes, 1970a.)
Age changed from Mesozoic to Early Cretaceous. (Hayes, 1970a.)
Wallace Creek Tongue adopted as upper member of Cody Shale. Separated from main body of Cody by Fales Sandstone Member of Mesaverde Formation. (Gill and others, 1970.)
Commercial Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)
Concepción Formation adopted. Underlies Mal Paso Formation (new). (McIntyre and others, 1970.)
Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
Age changed from Early Mississippian to Early Permian to Early Mississippian to Late Pennsylvanian. (Nelson and Ross, 1969.)
Corkscrew Quartzite abandoned. Its rocks reassigned to Zabriskie Quartzite. (Stewart, 1970.)
Cornett Basalt Member abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)
Coronados Volcanics adopted. (Eberlein and Churkin, 1970.)
Crooks Gap Conglomerate adopted. (Love, 1970.)
Dad Sandstone Member of Hale (1961) adopted. (Gill and others, 1970.)
Daly Swamp Member adopted. (Snyder, 1970.)
Caballo Blanco Rhyolite Tuff and Kneeling Nun Tuff made members of Datil Formation in Black Range area. Age changed from Tertiary to Oligocene. (Ericksen and others, 1970.)
Daylight Formation abandoned. Its rocks reassigned to Wood Canyon Formation. (Stewart, 1970.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
Descon Formation adopted. Underlies Heceta Limestone (new). (Eberlein and Churkin, 1970.)
Deseret Limestone extended into northeastern Utah. (Hansen, 1969.)
Age changed from Pliocene to Miocene and Pliocene. (Van Alstine, 1969.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
Dutton Creek Formation is coarse-grained conglomerate facies of Hanna Formation; Dutton Creek Formation therefore abandoned. (Gill and others, 1970.)
Age changed from Permian to Late Permian. (Detterman, 1970b.)
Echooka River Glaciation abandoned; considered equivalent to Itkillik Glaciation which name will now be used. (Detterman, 1970a.)
Age changed from Cretaceous to Late Jurassic. (Evernden and Kistler, 1970.)
Electra Lake Gabbro adopted. (Barker, 1969.)
Type Elk River Beds restricted to those beds in the type section below a wave-cut platform. Age changed from late Pleistocene to Pliocene or Pleistocene. (Clifton and Boggs, 1970.)

Name	Age	Location
Erda Formation	Middle Pennsylvanian (Atoka and Des Moines).	North-central Utah
Escabrosa Limestone	Early and Late Mississippian.	Arizona and New Mexico.
Evanston Formation	Late Cretaceous and Paleocene.	Southwestern Wyoming
Fales Sandstone Member (of Mesaverde Formation).	Late Cretaceous	Central Wyoming
Farmers Member (of Borden Formation).	Mississippian	Eastern Kentucky
Fearn Springs Member (of Nanafalia Formation of Wilcox Group).	Eocene	Mississippi
Finger Bay Volcanics	early Tertiary	Southwestern Alaska
Fish Creek Mountains Tuff.	early Miocene	Central Nevada
Flat Ridge Formation (of Mount Rogers Volcanic Group).	Precambrian	North Carolina, Virginia, and Tennessee.
Foote Creek Formation	Late Cretaceous and Paleocene.	Wyoming
Fossil Butte Member (of Green River Formation).	Eocene	Southwestern Wyoming
Fowkes Formation	Eocene to Pliocene(?)	Southwestern Wyoming
Frederika Formation	Miocene	Alaska
Freeman Silt	early Miocene (early Saucesian).	California
French Pond Granite	Middle(?) and Late(?) Devonian.	New Hampshire
Gaptank Formation	Middle and Late Pennsylvanian and Early Permian (Wolfcamp).	Western Texas
Gem Park Complex	Cambrian	Colorado
Gile Mountain Formation.	Early Devonian	Vermont and New Hampshire.
Glastonbury Gneiss	Devonian or Mississippian.	Connecticut
Glorieta Sandstone	Early Permian (late Leonard).	New Mexico
Golden Horn Limestone Lentil (of Hasen Creek Formation) (of Skolai Group).	Early Permian	Alaska
Gooseberry Member (of Fowkes Formation).	Pliocene	Southwestern Wyoming
Grainger Formation	Early Mississippian	Southeastern Kentucky

Revision and reference
Erda Formation adopted as middle formation of three in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Lake Point Limestone (new); underlies Kessler Canyon Formation (new). (Tooker and Roberts, 1970.)
Escabrosa Limestone raised to group rank in southeastern Arizona and southwestern New Mexico; includes (in ascending order): Keating and Hachita Formations. Remains of formation rank elsewhere. (Armstrong, 1970.)
Evanston Formation divided into lower member and Hams Fork Conglomerate Member (new) (Upper Cretaceous) and upper unit (Upper Cretaceous and Paleocene). (Oriel and Tracey, 1970.)
Fales Sandstone Member of Barwin (1961) adopted as basal member of Mesaverde Formation in southeastern Wind River basin. (Gill and others, 1970.)
Henley Bed adopted as basal unit of Farmers Member of Borden Formation. (Peck, 1969.)
Fearn Springs Member of Nanafalia Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
Age changed from Tertiary(?) to early Tertiary. (Scholl and others, 1970.)
Fish Creek Mountains Tuff adopted. (McKee, 1970.)
Flat Ridge Formation abandoned. Its rocks included in Mount Rogers Formation. (Rankin, 1970.)
Foote Creek Formation abandoned. Its rocks are lower or coal-bearing parts of Medicine Bow and Hanna Formations. (Gill and others, 1970.)
Fossil Butte Member adopted. (Oriel and Tracey, 1970.)
Fowkes Formation divided into three members (in ascending order): Sillem and Bulldog Hollow (both Eocene) and Gooseberry (Eocene(?) to Pliocene(?)) (all three new). Age changed from late Eocene to Eocene to Pliocene(?). (Oriel and Tracey, 1970.)
Frederika Formation adopted. (MacKevett, 1970.)
Freeman Silt of Kleinpell (1938) adopted. Overlies Jewett Sand; underlies Olcese Sand. (Addicott, 1970.)
Age changed from Late Devonian(?) to Middle(?) and Late(?) Devonian. (Cady, 1969.)
Upper part of Gaptank Formation placed in Wolfcamp Series. (Cooper and Grant, this report, p. A30.)
Gem Park Complex adopted. (Parker and Sharp, 1970.)
Age changed from Devonian to Early Devonian. (Cady, 1969.)
Glastonbury Gneiss of Gregory (1906) adopted. (Snyder, 1970.)
Age changed from Permian to Early Permian (late Leonard) in Fort Wingate area. (Ash, 1969.)
Golden Horn Limestone Lentil adopted. (Smith and MacKevett, 1970.)
Gooseberry adopted (provisionally assigned) as upper member. Overlies Bulldog Hollow Member (new). (Oriel and Tracey, 1970.)
Outcrop of Grainger Formation extended into southeastern Kentucky; previously known in southeastern Kentucky in subsurface only. (Csejtey, 1970).

Name	Age	Location
Grand Falls Chert Member (of Boone Formation).	Early Mississippian	Oklahoma and Kansas
Granite Creek Granodiorite.	Cretaceous	Idaho
Grant Lake Limestone	Late Ordovician	Northeastern Kentucky
Green Ravine Formation	Late Mississippian	North-central Utah
Green River Formation	Eocene	Southwestern Wyoming
Guacio Member (of Río Culebrinas Formation).	middle Eocene	Northwestern Puerto Rico.
Hachita Formation (of Escabrosa Group).	Early and Late Mississippian.	Southwestern New Mexico and southeastern Arizona.
Half Dome Quartz Monzonite.	Late Cretaceous	Eastern California
Halfway Draw Tuff Member (of Wind River Formation).	early Eocene	Wyoming
Hams Fork Conglomerate Member (of Evanston Formation).	Late Cretaceous	Southwestern Wyoming
Hanna Formation	Paleocene	Wyoming
Hartford Hill Rhyolite Tuff.	early Miocene	Western Nevada
Hartselle Sandstone	Late Mississippian	Southeastern Kentucky
Hasen Creek Formation (of Skolai Group).	Early Permian	Alaska
Hatchetigbee Formation	Eocene	Mississippi
Hatfield Sandstone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous	Wyoming
Hawi Volcanic Series	late Pleistocene	Hawaii
Hayden Creek Drift (of Salmon Springs Glaciation).	Pleistocene	Washington
Haystack Mountains Formation (of Mesaverde Group).	Late Cretaceous	South-central Wyoming
Hebron Formation	Ordovician or older	Connecticut
Heceta Limestone	Middle and Late Silurian.	Southeastern Alaska

Revision and reference
Age changed from Mississippian to Early Mississippian. (McKnight and Fischer, 1970.)
Age changed from Jurassic or Cretaceous to Cretaceous. (King and others, 1970.)
Tate Member of Ashlock Formation in central Kentucky extended into northeastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
Green Ravine Formation adopted. Recognized in Rogers Canyon sequence (northern Oquirrh Mountains). Underlies Oquirrh Group. (Tooker and Roberts, 1970.)
Green River Formation in Fossil Basin divided into two members (in ascending order): Fossil Butte and Angelo Members (both new). (Oriel and Tracey, 1970.)
Guacio Member adopted. Underlies Maricao Basalt. (McIntyre and others, 1970.)
Hachita Formation of Armstrong (1962) adopted as upper formation of Escabrosa Group. (Armstrong, 1970.)
Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
Halfway Draw Tuff Member adopted. (Love, 1970.)
Hams Fork Conglomerate Member adopted. (Oriel and Tracey, 1970.)
Age changed from Eocene to Paleocene; restricted to Hanna and Carbon basins. (Gill and others, 1970.)
Age changed from Oligocene(?) to early Miocene. (Moore, 1969.)
Hartselle Sandstone changed to Hartselle Formation in southeastern Kentucky. (Lewis and Luft, 1970.)
Hasen Creek adopted as upper of two formations in Skolai Group (new). Overlies Station Creek Formation (new). Includes Golden Horn Limestone Lentil (new). (Smith and MacKevett, 1970.)
Hatchetigbee Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. Includes Bashi Marl Member. (Cushing and others, 1970.)
Hatfield Sandstone Member of Hale (1961) adopted as uppermost named member of Haystack Mountains Formation in Hanna and Carbon basins. (Gill and others, 1970.)
Age changed from Pliocene and early and middle Pleistocene to late Pleistocene. (McDougall, 1969.)
Hayden Creek Drift adopted. (Crandell, 1969.)
Haystack Mountains Formation adopted as basal formation of Mesaverde Group in Hanna and Carbon basins. Includes (in ascending order): Tapers Ranch Sandstone Member, lower unnamed member, O'Brien Spring Sandstone Member, middle unnamed member, Hatfield Sandstone Member, and upper unnamed member. (Gill and others, 1970.)
Age changed from Early Devonian or older to Ordovician or older. (Snyder, 1970.)
Heceta Limestone adopted. Overlies Descon Formation (new); underlies Karheen Formation (new). (Eberlein and Churkin, 1970.)

Name	Age	Location
Heceta Limestone	Early through Late Silurian.	Southeastern Alaska
Hempfield Shale	Mississippian	Pennsylvania and Ohio
Henley Bed (of Farmers Member).	Mississippian	Eastern Kentucky
Hidalgo Volcanics	Late Cretaceous	New Mexico
Highland Boy Limestone Member (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Highlandcroft Plutonic Series.	Middle or Late Ordovician.	New Hampshire
Hines Tongue (of Reed Dolomite).	Precambrian	Southern Nevada
Hinsdale Formation	Miocene and Pliocene	New Mexico and Colorado.
Hite Bed of Church Rock Member (of Chinle Formation).	Late Triassic	Northeastern Arizona
Hoosac Formation	Early Cambrian or older.	Massachusetts, Connecticut, and Vermont.
Horquilla Limestone	Early, Middle, and Late Pennsylvanian.	Southwestern New Mexico and southeastern Arizona.
Horseshoe Mesa Member (of Redwall Limestone).	Late Mississippian (Meramec and Chester).	Arizona
House Limestone (of Pogonip Group).	Late Cambrian and Early Ordovician.	Western Utah and eastern Nevada.
Huachuca Quartz Monzonite.	Jurassic	Arizona
Humbug Formation	Late Mississippian	Utah
Hurrah Slate	Precambrian	Northwestern Alaska
Ice Point Conglomerate	Eocene	Wyoming
Irving Greenstone	Precambrian	Southwestern Colorado
Jewett Sand	lower Miocene	California
John Day Formation	middle Oligocene to early Miocene.	Oregon
Jones Ridge Limestone	Early Cambrian to Middle or Late Ordovician.	East-central Alaska
Joplin Member (of Boone Formation).	Early Mississippian	Oklahoma and Kansas
Jordan Limestone Member (of Bingham Quartzite).	Pennsylvanian	North-central Utah

Revision and reference
Age changed from Middle and Late Silurian to Early through Late Silurian. (Ovenshine and Webster, 1970.)
Hempfield Shale abandoned; now upper unnamed member of Shenango Formation. (Kimmel and Schiner, 1970.)
Henley Shale Member of New Providence Formation as used by Stockdale (1939) adopted as Henley Bed, basal unit of Farmers Member of Borden Formation. (Peck, 1969.)
Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
Highland Boy Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)
Age changed from Late Ordovician to Middle or Late Ordovician. (Cady, 1969.)
Hines Tongue extended into southern Nevada. (Stewart, 1970.)
Age changed from late Tertiary to Miocene and Pliocene. (Lipman and others, 1970.)
Hite Bed extended into northeastern Arizona. (O'Sullivan, 1970.)
Age changed from Early(?) Cambrian to Early Cambrian or older. (Hatch, 1969.)
Horquilla Limestone extended into southwestern New Mexico. Age in report area is Early Pennsylvanian. (Armstrong, 1970.)
Age changed from Mississippian to Late Mississippian (Meramec and Chester). (McKee and Gutschick, 1969.)
House Limestone of Hintze (1951) adopted as lowermost formation of Pogonip Group and extended from its type area, western Utah, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
Age changed from Jurassic(?) to Jurassic. (Hayes, 1970b.)
Humbug Formation extended into northeastern Utah. (Hansen, 1969.)
Age changed from post-Ordovician(?) to Precambrian. (Sainsbury and others, 1970.)
Ice Point Conglomerate adopted. (Love, 1970.)
Irving Greenstone changed to Irving Formation. Also includes Archean schist and gneiss of Cross, Howe, Irving, and Emmons (1905), in southwestern and northern Needle Mountains. (Barker, 1969.)
Jewett zone designated by Godde (1928) adopted as Jewett Sand. Includes Pyramid Hill Sand Member at its base. Overlies Vedder Sand (when present) or Walker Formation; underlies Freeman Silt. (Addicott, 1970.)
Age changed from late Oligocene and early Miocene to middle Oligocene to early Miocene. (Swanson, 1969.)
Age changed from Cambrian to Middle or Late Ordovician to Early Cambrian to Middle or Late Ordovician. (Brabb and Churkin, 1969.)
Joplin Member adopted. (McKnight and Fischer, 1970.)
Jordan Limestone Member abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)

Name	Age	Location
Kanosh Shale (of Pogonip Group).	Middle Ordovician	Eastern Nevada and western Utah.
Karheen Formation	Late Silurian and Early Devonian.	Southeastern Alaska
Karluk Glaciation or Drift.	Pleistocene	Alaska
Katakturuk Dolomite	Middle Devonian or older.	Northeastern Alaska
Keating Formation (of Escabrosa Group).	Early Mississippian	Southeastern Arizona and southwestern New Mexico.
Keechelus Andesitic Series.	Eocene to Miocene	Washington
Kekiktuk Conglomerate (of Endicott Group).	Mississippian	Northeastern Alaska
Kessler Canyon Formation (of Oquirrh Group).	Late Pennsylvanian (Virgil) and Early Permian(?) (Wolfcamp?).	North-central Utah
Kigluaik Group	Precambrian	Northwestern Alaska
Kinsman Quartz Monzonite.	Early(?) Devonian	New Hampshire
Klawak Formation	Early and Middle Pennsylvanian.	Southeastern Alaska
Kneeling Nun Tuff	Oligocene	New Mexico
Kneeling Nun Tuff	Oligocene	Southwestern New Mexico.
Ladrones Limestone	Early and Middle Pennsylvanian.	Southeastern Alaska
La Jara Canyon Member (of Treasure Mountain Tuff).	Oligocene	Colorado
Lake Fork Formation	Oligocene and older(?)	Southwestern Colorado
Lake Point Limestone (of Oquirrh Group).	Late Mississippian and Early Pennsylvanian.	North-central Utah
Lamarck Granodiorite	Late Cretaceous	Eastern California
Lead Camp Limestone	Middle Pennsylvanian (Des Moines).	New Mexico
Lehman Formation (of Pogonip Group).	Middle Ordovician	Western Utah and eastern Nevada.
Lenox Limestone Member (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Lewis Shale	Late Cretaceous	Central Wyoming
Lisburne Group	Early and Late Mississippian.	Northern Alaska

Revision and reference
Kanosh Shale of Hintze (1951) adopted and included in Pogonip Group. Underlies Lehman Formation. Extended from its type area, western Nevada, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
Karheen Formation adopted. Overlies Heceta Limestone (new): (Eberlein and Churkin, 1970.)
Karluk Glaciation or Drift adopted. (Karlstrom, 1969.)
Katakturuk Dolomite adopted. Underlies Nanook Limestone (new). (Dutro, 1970.)
Keating Formation of Armstrong (1962) adopted as lower formation of Escabrosa Group. (Armstrong, 1970.)
Keechelus Andesitic Series abandoned. Its rocks designated by informally-named stratigraphic unit. (Vine, 1969.)
Age changed from Late(?) Devonian or Mississippian to Mississippian. (Reiser, 1970.)
Kessler Canyon Formation adopted as uppermost of three formations in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Erda Formation (new); underlies Park City Formation. (Tooker and Roberts, 1970.)
Age changed from Devonian(?) to Precambrian. (Sainsbury and others, 1970.)
Age changed from Late Devonian(?) to Early(?) Devonian. (Cady, 1969.)
Klawak Formation adopted. (Eberlein and Churkin, 1970.)
Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
Kneeling Nun Tuff made a member of Datil Formation in Black Range area, southwestern New Mexico. Remains of formation rank elsewhere. (Ericksen and others, 1970.)
Ladrones Limestone adopted. (Eberlein and Churkin, 1970.)
La Jara Canyon Member adopted. (Lipman and Steven, 1970.)
Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
Lake Point Limestone adopted as lowermost of three formations in Oquirrh Group in Rogers Canyon sequence (northern Oquirrh Mountains). Overlies Green Ravine Formation (new); underlies Erda Formation (new). (Tooker and Roberts, 1970.)
Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
Age changed from Pennsylvanian to Middle Pennsylvanian (Des Moines). (Bachman and Harbour, 1970.)
Lehman Formation of Hintze (1951) adopted as uppermost formation, locally, of Pogonip Group. Overlies Kanosh Shale. Extended from its type area, western Utah, into southern Snake Range, east-central Nevada. (Whitebread, 1969.)
Lenox Limestone Member abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
Lewis Shale divided into lower part, Dad Sandstone Member, and upper part in Hanna and Carbon basins. (Gill and others, 1970.)
In central and eastern Brooks Range age changed from Early and Late Mississippian, Pennsylvanian(?) and Permian to Early Mississippian (Osage) to Middle Pennsylvanian (Atoka). Elsewhere it is Early and Late Mississippian. (Armstrong and others, 1970.)

Name	Age	Location
Littleton Formation	Late Silurian(?) and Early Devonian.	Connecticut, Massachusetts, and New Hampshire.
Livingston Hills Formation.	Cretaceous or Tertiary	Southwestern Arizona
Los Pinos Gravel	Oligocene to Pliocene	New Mexico and Colorado.
Lykins Formation	Permian and Triassic(?).	Colorado
Mal Paso Formation	Eocene	Northwestern Puerto Rico.
Maricao Basalt	Late Cretaceous	Northwestern Puerto Rico.
Markham Peak Member (of Bingham Mine Formation).	Late Pennsylvanian	North-central Utah
Marquette Range Supergroup.	middle Precambrian	Northern Michigan and northern Wisconsin.
Matilde Formation	middle Eocene	Puerto Rico
McClure Mountain Complex.	Cambrian	Colorado
McNeeley Drift (of Fraser Glaciation).	Pleistocene	Washington
Medicine Bow Formation.	Late Cretaceous	Wyoming
Menard Limestone	Late Mississippian	Kentucky
Menominee Group	middle Precambrian	Northern Michigan and northern Wisconsin.
Mesaverde Group	Late Cretaceous	Wyoming
Mifflintown Formation	Middle Silurian	South-central Pennsylvania.
Milagros Formation	middle Eocene	Puerto Rico
Moat Volcanics	Permian(?)	New Hampshire
Moccasin Bend Member (of Boone Formation).	Late Mississippian	Oklahoma and Kansas
Molas Formation	Mississippian and Early Pennsylvanian (Morrow).	Colorado, New Mexico, and Arizona.
Monmouth Group	Late Cretaceous	New York, Pennsylvania, and New Jersey.

Revision and reference
Age changed from Early Devonian to Late Silurian(?) and Early Devonian. (Cady, 1969.)
Livingston Hills Formation adopted. (Miller, 1970.)
Los Pinos Gravel changed to Los Pinos Formation; age changed from Miocene and Pliocene(?) to Oligocene to Pliocene. (Lipman and others, 1970.)
Age changed from Permian(?) and Triassic(?) to Permian and Triassic(?). (Scott, 1970.)
Mal Paso Formation adopted. Overlies Concepción Formation (new); underlies Rio Culebrinas Formation. (McIntyre and others, 1970.)
Maricao Basalt of Mattson (1960) adopted. Overlies Yauco Mudstone. (McIntyre and others, 1970.)
Markham Peak Member adopted as upper member. Recognized in Bingham sequence (central and southern Oquirrh Mountains). Overlies Clipper Ridge Member (new). (Tooker and Roberts, 1970.)
Marquette Range Supergroup adopted. Includes (in ascending order): Chocolay, Menominee, Baraga, and Paint River Groups. Replaces Animikie Series (abandoned). Animikie Group remains in good usage in northern Minnesota. (Cannon and Gair, 1970.)
Age changed from late Paleocene and Eocene to middle Eocene. (McIntyre and others, 1970.)
Age changed from Precambrian or Cambrian to Cambrian. (Parker and Sharp, 1970.)
McNeeley Drift adopted. (Crandell, 1969.)
Medicine Bow Formation restricted to Hanna, Laramie, and Carbon basins. (Gill and others, 1970.)
Menard Limestone made member of Buffalo Wallow Formation in north-central Kentucky. Menard Limestone remains in good usage in Illinois and western Kentucky. (Goudarzi, 1970.)
Menominee Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
Mesaverde Formation raised to Mesaverde Group in south-central Wyoming where it is composed of the Haystack Mountains Formation, Allen Ridge Formation, Pine Ridge Sandstone, and Almond Formation. In Laramie basin, group composed only of Rock River Formation and Pine Ridge Sandstone. Mesaverde Formation still recognized in southeastern Wind River basin where divided into Fales Sandstone Member, Parkman Sandstone Member, unnamed middle member, and Teapot Sandstone Member, and in Powder River basin where divided into Parkman Sandstone Member, unnamed marine shale member, and Teapot Sandstone Member. (Gill and others, 1970.)
Mifflintown Formation as used and redefined by Miller and Conlin (in Miller, 1961) adopted. (de Witt, this report, p. A28.)
Age changed from Eocene(?) to middle Eocene. (McIntyre and others, 1970.)
Age changed from Late Permian to Permian(?). (Cady, 1969.)
Moccasin Bend Member adopted. (McKnight and Fischer, 1970.)
Age changed from Pennsylvanian to Mississippian and Early Pennsylvanian (Morrow). (Mutschler, 1970.)
Monmouth Group abandoned in Maryland and Delaware; remains in good usage in New Jersey, Pennsylvania, and New York. Monmouth Formation remains in good usage in Maryland near District of Columbia. (Owens and others, 1970.)

Name	Age	Location
Monterey Formation	Miocene	California
Mooney Falls Member (of Redwall Limestone).	Early and Late Mississippian (Meramec and Osage).	Arizona
Morales Member (of Santa Margarita Formation).	late Miocene	California
Mount Rogers Formation	Precambrian	North Carolina, Virginia, and Tennessee.
Nanafalia Formation (of Wilcox Group).	Eocene	Mississippi
Nanook Limestone	Middle Devonian	Northeastern Alaska
Nathrop Volcanics	Late Oligocene	Colorado
Needles Range Formation.	Oligocene	Southwestern Utah and eastern Nevada.
Nelson Mountain Quartz Latite.	Oligocene	Colorado
New Hampshire Plutonic Series.	Devonian	New Hampshire and Vermont.
Nome Group	Precambrian	Northwestern Alaska
Nonesuch Shale	Precambrian	Michigan and Wisconsin.
Northfield Formation	Middle(?) Silurian	Vermont
Obispo Tuff Member (of Monterey Formation).	Miocene	California
O'Brien Spring Sandstone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous	Wyoming
Ojito Creek Member (of Treasure Mountain Tuff).	Oligocene	Colorado
Olcese Sand	middle Miocene	California
Oquirrh Formation	Late Mississippian to Early Permian(?).	North-central Utah
Oquirrh Formation	Pennsylvanian and Permian.	Northwestern Utah

Revision and reference
Obispo Tuff Member, basal member of Monterey Formation, removed from Monterey Formation and raised in rank to Obispo Formation following usage of Hall and others (1966). (Turner and others, 1970.)
Age changed from Mississippian to Early and Late Mississippian (Meramec and Osage). (McKee and Gutschick, 1969.)
Morales Member of Santa Margarita Formation raised in rank to Morales Formation. Age changed from late Miocene to Pliocene. (Vedder, 1970.)
Mount Rogers Volcanic Group reduced from group to formation rank and name changed to Mount Rogers Formation. Its former subdivisions, Flat Ridge Formation containing Cinnamon Ridge and Cornett Basalt Members, abandoned and their rocks included in Mount Rogers Formation. (Rankin, 1970.)
Nanafalia Formation of Wilcox Group used in central Mississippi. Previously Wilcox Group had not been differentiated in this area. Includes Fearn Springs Member. (Cushing and others, 1970.)
Nanook Limestone adopted. Overlies Katakturuk Dolomite (new). Dutro, 1970.)
Nathrop Volcanics adopted. (Van Alstine, 1969.)
Needles Range Formation extended into eastern Nevada. Age changed from Eocene or early Oligocene to Oligocene. (Whitebread, 1969.)
Age changed from middle or late Tertiary to Oligocene. (Lipman and others, 1970.)
Age changed from Late Devonian(?) to Devonian. (Cady, 1969.)
Age changed from Silurian and Ordovician to Precambrian. (Sainsbury and others, 1970.)
Nonesuch Shale extended into Wisconsin (northwestern part). (Vine and Tourtelet, 1969.)
Name changed from Northfield Slate to Northfield Formation; age changed from Middle Silurian to Middle(?) Silurian. (Cady, 1969.)
Obispo Tuff Member removed from Monterey Formation and raised in rank to Obispo Formation following usage of Hall and others (1966). (Turner and others, 1970.)
O'Brien Spring Sandstone Member adopted as middle named member of Haystack Mountains Formation. (Gill and others, 1970.)
Ojito Creek Member adopted. (Lipman and Steven, 1970.)
Olcese Sand of Diepenbrock (1933) adopted. Overlies Freeman Silt; underlies Round Mountain Silt. (Addicott, 1970.)
In Oquirrh Mountains, its type area, Oquirrh Formation raised in rank to Oquirrh Goup. Age ranges from Late Mississipian to Early Permian(?). South of Midas thrust, in Bingham sequence, contains (in ascending order): West Canyon Limestone, Butterfield Peaks Formation, and Bingham Mine Formation. Age there is Early, Middle, and Late Pennsylvanian. North of the North Oquirrh thrust, in the Rogers Canyon sequence, includes (in ascending order): Lake Point Limestone and Erda and Kessler Formations. Age is Late Mississippian to Early Permian(?). Overlies Green Ravine Formation; underlies Park City Formation. (Tooker and Roberts, 1970.)
In Curlew Valley, northwestern Utah, the Oquirrh is of formational rank and of Pennsylvanian and Permian age. (Bolke and Price, 1969.)

Name	Age	Location
Oreville Formation	Precambrian	South Dakota
Packsaddle Mountain Granodiorite.	Cretaceous	Idaho
Pahrump Series	late Precambrian	Southeastern California
Paint River Group	middle Precambrian	Northern Michigan and northern Wisconsin.
Panther Seep Formation	Late Pennsylvanian and Early Permian.	New Mexico
Paradise Formation	Late Mississippian	Southeastern Arizona and southwestern New Mexico.
Paskenta Formation	Early Cretaceous	California and Oregon
Peratrovich Formation	Early and Late Mississippian.	Southeastern Alaska
Perryville Member (of Lexington Limestone).	Middle Ordovician	Kentucky
Phoenix Limestone Lentil (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Pine Ridge Sandstone Member (of Mesaverde Formation).	Late Cretaceous	Wyoming
Pinnacle Formation	Early Cambrian(?)	Vermont
Pioche Shale	Cambrian	Northeastern Nevada
Pogonip Group	Late Cambrian, Early and Middle Ordovician.	Eastern Nevada and western Utah.
Point Pleasant Formation.	Middle and Late Ordovician.	North-central Kentucky
Polulu Volcanic Series	late Pleistocene	Hawaii
Poplar Tank Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas
Port Refugio Formation	Late Devonian	Southeastern Alaska
Potosi Volcanic Group	Oligocene	Southwestern Colorado
Prospect Mountain Quartzite.	Precambrian and Early Cambrian.	Southeastern California and southern Nevada.
Puckmummie Schist	Precambrian	Northwestern Alaska
Pyramid Hill Sand Member (of Jewett Sand).	early Miocene	California
Quapaw Limestone	Late Mississippian	Oklahoma
Rainstorm Member (of Johnnie Formation).	late Precambrian	Southeastern California
Ra Jadero Member (of Treasure Mountain Tuff).	Oligocene	Southwestern Colorado
Rampart Group	Permian(?)	Central Alaska
Rat Creek Quartz Latite	Oligocene	Colorado

Revision and reference
Oreville Formation adopted. (Ratte and Wayland, 1969.)
Age changed from probably Jurassic or Cretaceous to Cretaceous. (King and others, 1970.)
Name changed from Pahrump Series to Pahrump Group; definition remains unchanged. (Stewart, 1970.)
Paint River Group removed from Animikie Series (abandoned) and placed in Marquette Range Supergroup (new). (Cannon and Gair, 1970.)
Age changed from Late Pennsylvanian to Late Pennsylvanian and Early Permian. (Bachman and Harbour, 1970.)
Paradise Formation of Stoyanow (1926) adopted. (Armstrong, 1970.)
Paskenta Formation abandoned as it was defined as biostratigraphic unit. (Jones and others, 1969.)
Peratrovich Formation adopted; overlies Wadleigh Limestone (new). (Eberlein and Churkin, 1970.)
Name changed from Perryville Member to Perryville Limestone Member. (Cressman and Hrabar, 1970.)
Phoenix Limestone Lentil abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
In Hanna, Carbon, and Laramie basins, Pine Ridge Sandstone Member raised to formation rank in Mesaverde Group. (Gill and others, 1970.)
Age changed from Cambrian(?) to Early Cambrian(?). (Cady, 1969.)
Name changed to Pioche Formation in the Ruby Mountains where the shale is metamorphosed. (Willden and Kistler, 1969.)
Pogonip Group in southern Snake Range includes (in ascending order): House Limestone, an unnamed limestone unit, Lehman Formation, and Kanosh Shale. Age locally is Late Cambrian and Early and Middle Ordovician. (Whitebread, 1969.)
Age changed from Middle Ordovician to Middle and Late Ordovician. (Luft, 1970.)
Age changed from Pliocene to late Pleistocene. (McDougall, 1969.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
Port Refugio Formation adopted. (Eberlein and Churkin, 1970.)
Age changed from middle and late Tertiary to Oligocene. (Lipman and others, 1970.)
Prospect Mountain Quartzite restricted from Kingston Range and Clark Mountain area; replaced by (in ascending order): Johnnie, Stirling, Wood Canyon, and Zabriskie Formations. (Stewart, 1970.)
Age changed from post-Ordovician(?) to Precambrian. (Sainsbury and others, 1970.)
Pyramid Hill Sand of Wilson (1935) adopted as basal member of Jewett Sand. (Addicott, 1970.)
Quapaw Limestone adopted. (McKnight and Fischer, 1970.)
Rainstorm Member extended into southeastern California. (Stewart, 1970.)
Ra Jadero Member adopted. (Lipman and Steven, 1970.)
Age changed from Mississippian to Permian(?). (Brosgé and others, 1969.)
Age changed from middle or late Tertiary to Oligocene. (Lipman and others, 1970.)

Name	Age	Location
Rawley Andesite	Oligocene	Southwestern Colorado
Reeds Spring Member (of Boone Formation).	Early Mississippian	Oklahoma
Ringbone Shale	Late Cretaceous	New Mexico
Río Blanco Formation	Late Cretaceous	Northwestern Puerto Rico.
Río Culebrinas Formation.	Eocene	Northwestern Puerto Rico.
Roadside Formation	Late Cretaceous	Arizona
Rock River Formation (of Mesaverde Group).	Late Cretaceous	Wyoming
Roskruge Rhyolite	Late Cretaceous	Arizona
Round Mountain Silt	middle Miocene	California
Round Valley Peak Granodiorite.	Late Cretaceous	Eastern California
Rubio Peak Formation	Oligocene	New Mexico
Ruby Star Granodiorite	Paleocene	Southern Arizona
Russell Mountain Formation.	Middle Silurian	Western Massachusetts
Sadlerochit Formation	Late Permian and Early Triassic.	Northern Alaska
Sag River Sandstone	Late Triassic	Northern Alaska
St. Joe Limestone Member (of Boone Formation).	Early Mississippian	Oklahoma
St. Joseph Island Volcanics.	Devonian(?)	Southeastern Alaska
Salem Limestone	Late Mississippian	Eastern Kentucky
San Andres Limestone	Early Permian (Leonard).	Northwestern New Mexico.
Sangre de Cristo Formation.	Late Pennsylvanian and Early Permian.	New Mexico and Colorado.
San Juan Formation	Oligocene and older (?)	Southwestern Colorado
San Ramon Sandstone	early Miocene(?)	California
Satanka Shale	Permian	Colorado and Wyoming
Savanna Shale (of Krebs Group).	Pennsylvanian	Oklahoma and Kansas
Schieffelin Granodiorite	Late Cretaceous	Arizona
Servilleta Formation	Pliocene	Colorado and New Mexico.
Shawangunk Conglomerate.	Early and Middle Silurian.	Eastern Pennsylvania and northeastern New Jersey.

Revision and reference
Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)
Name changed from Reeds Spring Chert Member to Reeds Spring Member. (McKnight and Fischer, 1970.)
Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
Río Blanco Series of Hubbard (1923) adopted as Río Blanco Formation. (McIntyre and others, 1970.)
Río Culebrinas Series of Hubbard (1923) adopted and redefined as Río Culebrinas Formation. Overlies Mal Paso Formation (new). (McIntyre and others, 1970.)
Age changed from Mesozoic to Late Cretaceous. (Hayes, 1970a.)
Rock River Formation adopted as basal formation in Mesaverde Group along west flank of Laramie Basin. Does not occur east of Laramie Range and to west grades into Allen Ridge Formation of Mesaverde Group. (Gill and others, 1970.)
Age changed from Mesozoic to Late Cretaceous. (Hayes, 1970a.)
Round Mountain Silt of Diepenbrock (1933) adopted. Overlies Olcese Sand (new). (Addicott, 1970.)
Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
Ruby Star Granodiorite of Livingston, Mauger, and Damon (1968) adopted. (Lovering and others, 1970.)
Russell Mountain Formation adopted. (Hatch and others, 1970.)
Age changed from Permian and Early Triassic to Late Permian and Early Triassic. (Detterman, 1970b.)
Sag River Sandstone of Fackler and others (1970) adopted. (Reiser, 1970.)
Age changed from Mississippian to Early Mississippian. (McKnight and Fischer, 1970.)
St. Joseph Island Volcanics adopted. (Eberlein and Churkin, 1970.)
Name changed from Salem Limestone to Salem Formation in eastern Kentucky. (Lewis and Luft, 1970.)
In Fort Wingate area, New Mexico, age changed from Early and Late Permian to Early Permian (Leonard). (Ash, 1969.)
Age changed from Pennsylvanian and Permian to Late Pennsylvanian and Early Permian. (Johnson, 1970.)
Age changed from Oligocene or older to Oligocene and older(?) (Lipman and others, 1970.)
Age changed from late Oligocene or early Miocene to early Miocene(?). (Addicott, 1970.)
Name changed from Satanka Shale to Satanka Formation in report area. (Braddock and others, 1970.)
Name changed from Savanna Formation to Savanna Shale in report area. Savanna Formation or Sandstone is good usage elsewhere. (McKnight and Fischer, 1970.)
Age changed from Late Cretaceous or Tertiary to Late Cretaceous. (Hayes, 1970a.)
Servilleta Formation of Montgomery (1953) adopted. (Lipman and others, 1970.)
In report area name changed to Formation and age changed from Silurian to Early and Middle Silurian. (Drake and others, 1969.)

Name	Age	Location
Shenango Formation	Mississippian	Pennsylvania and Ohio
Shingle Creek Quartzite	late Precambrian	Eastern Nevada and western Utah.
Short Creek Oolite Member (of Boone Formation).	Late Mississippian	Oklahoma and Kansas
Sillem Member (of Fowkes Formation).	Eocene	Southwestern Wyoming
Silver Point Quartz Monzonite.	Mesozoic(?)	Northeastern Washington.
Skinner Ranch Formation.	Early Permian (Wolfcamp).	Western Texas
Skokomish Gravel	Pleistocene (Olympia Interglaciation).	West-central Washington.
Skolai Group	Permian(?) and Permian.	Alaska
Skunk Ranch Conglomerate.	Late Cretaceous	New Mexico
Snow Creek Porphyry	early Tertiary	Montana
Station Creek Formation	Permian(?)	Alaska
Sturgeon River Glaciation or Drift.	Pleistocene	Alaska
Sugarlump Tuff	Oligocene	New Mexico
Sullivan Peak Member (of Skinner Ranch Formation).	Early Permian (Wolfcamp).	Western Texas
Sunset Member (of Bull Fork Formation).	Late Ordovician	Northeastern Kentucky.
Sunshine Peak Rhyolite	Oligocene	Southwestern Colorado
Taft Granite	Late Jurassic	Eastern California
Talisay Member (of Alifan Limestone).	Miocene	Guam
Tapeats Sandstone	Early Cambrian	Southeastern California.
Tapers Ranch Sandstone Member (of Haystack Mountains Formation) (of Mesaverde Group).	Late Cretaceous	Wyoming
Tate Member (of Ashlock Formation).	Late Ordovician	Northeastern Kentucky
Theresa Formation	Late Cambrian and Early Ordovician.	Vermont and New York
Thunder Springs Member (of Redwall Limestone).	Early Mississippian (Osage).	Arizona
Tilden Limestone Lentil (of Bingham Quartzite).	Pennsylvanian	North-central Utah
Tracy Creek Quartz Latite.	Oligocene	Southwestern Colorado

Revision and reference
Shenango Formation revised to include Shenango Formation, as previously used, as unnamed lower member and the Hempfield Shale (abandoned) as unnamed upper member. (Kimmel and Schiner, 1970.)
Shingle Creek Quartzite of Misch and Hazzard (1962) adopted. (Whitebread, 1969.)
Age changed from Mississippian to Late Mississippian. (McKnight and Fischer, 1970.)
Sillem adopted as basal member. Underlies Bulldog Hollow Member (new). (Oriel and Tracey, 1970.)
Silver Point Quartz Monzonite adopted. (Miller, 1969.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
Skokomish Gravel adopted. (Molenaar and Noble, 1970.)
Skolai Group adopted. Includes (in ascending order): Station Creek and Hasen Creek Formations (both new). (Smith and MacKevett, 1970.)
Age changed from Early Cretaceous to Late Cretaceous. (Hayes, 1970a.)
Age changed from post-Cretaceous(?) to early Tertiary. (Witkind and others, 1970.)
Station Creek adopted as lower of two formations in Skolai Group (new). Underlies Hasen Creek Formation (new). (Smith and MacKevett, 1970.)
Sturgeon River Glaciation or Drift adopted. (Karlstrom, 1969.)
Age changed from Miocene(?) to Oligocene. (Jones and others, 1970.)
Age changed from Early Permian (Leonard) to Early Permian (Wolfcamp). (Cooper and Grant, this report, p. A30.)
Sunset Member of Arnheim Formation of Foerste (1912) adopted as Sunset Member of Bull Fork Formation. (Outerbridge, 1970.)
Age changed from middle and late Tertiary to Oligocene. (Lipman and others, 1970.)
Age changed from Cretaceous to Late Jurassic. (Evernden and Kistler, 1970.)
Age changed from Miocene and Pliocene to Miocene. (Leopold, 1969.)
Strata of Tapeats Sandstone in Providence Mountains reassigned to Johnnie, Stirling, Wood Canyon, and Zabriskie Formations. (Stewart, 1970.)
Tapers Ranch Sandstone Member adopted as basal member of Haystack Mountains Formation in Hanna and Carbon basins. (Gill and others, 1970.)
Tate Member of Ashlock Formation in central Kentucky extended into northeastern Kentucky as Tate Member of Grant Lake Limestone. (Outerbridge, 1970.)
Name changed from Theresa Dolomite to Theresa Formation; age changed from Late Cambrian to Late Cambrian and Early Ordovician. (Cady, 1969.)
Age changed from Mississippian to Early Mississippian (Osage). (McKee and Gutschick, 1969.)
Tilden Limestone Lentil abandoned. Its rocks included in Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
Age changed from Miocene(?) to Oligocene. (Lipman and others, 1970.)

Name	Age	Location
Treasure Mountain Rhyolite.	Oligocene	Southwestern Colorado
Tunp Member (of Wasatch Formation).	Eocene	Southwestern Wyoming
Tuolumne Intrusive Series.	Late Cretaceous	California
Tuscahoma Formation (of Wilcox Group).	Eocene	Mississippi
Twilight Granite	Precambrian	Southwestern Colorado
Utica Shale	Middle Ordovician	Eastern New York
Vedder Sand	early Miocene	California
Vekol Formation	Late Cretaceous	Arizona
Vicksburg Group	early Oligocene	Louisiana, Alabama, and Mississippi.
Wachsmuth Limestone (of Lisburne Group).	Early and Late Mississippian.	Northern Alaska
Wadleigh Limestone	Middle and Late Devonian.	Southeastern Alaska
Wahoo Limestone (of Lisburne Group).	Early and Middle Pennsylvanian.	Northern Alaska
Walker Formation	middle or late Eocene to early Miocene.	California
Wallace Creek Tongue (of Cody Shale).	Late Cretaceous	Wyoming
Waltersburg Formation/ Sandstone.	Late Mississippian	Kentucky
Wasatch Formation	Paleocene and Eocene	Southwestern Wyoming
West Canyon Limestone	Early Pennsylvanian	North-central Utah
West Elk Breccia	Oligocene and older(?)	Southwestern Colorado
Whitehead Granite	Precambrian	Southwestern Colorado
White Knob Limestone	Late Mississippian	Idaho
White Mountain Plutonic Series.	Late Triassic or Early Jurassic.	New Hampshire
Whiteside Granite	Precambrian(?)	South Carolina and North Carolina.
Whitmore Wash Member (of Redwall Limestone).	Early Mississippian (Kinderhook and Osage).	Arizona
Wilcox Group	Eocene	Mississippi

Revision and reference
Name changed to Treasure Mountain Tuff; includes (in ascending order): lower tuff, La Jara Canyon Member (new), middle tuff, Ojito Creek Member (new), Ra Jadero Member (new), and upper tuff. (Lipman and Steven, 1970.)
Tunp Member adopted. (Oriel and Tracey, 1970.)
Age changed from Cretaceous to Late Cretaceous. (Evernden and Kistler, 1970.)
Tuscahoma Formation of Wilcox Group used in central Mississippi. Previously the Wilcox Group had not been differentiated in this area. (Cushing and others, 1970.)
Name changed from Twilight Granite to Twilight Gneiss. (Barker, 1969.)
Age changed from Late Ordovician to Middle Ordovician in report area. Remains Late Ordovician elsewhere. (Cady, 1969.)
Vedder Sand as redefined by Diepenbrock (1933) adopted. When present: overlies Walker Formation; underlies Jewett Sand. (Addicott, 1970.)
Age changed from Late(?) Mesozoic to Late Cretaceous. (Hayes, 1970a.)
Age changed from middle Oligocene to early Oligocene. (Bukry, 1970.)
Age changed from Early Mississippian to Early and Late Mississippian. (Armstrong and others, 1970.)
Underlies the Peratrovich Formation of Early and Late Mississippian age. (Eberlein and Churkin, 1970.)
Age changed from Pennsylvanian(?) and Permian to Early and Middle Pennsylvanian. (Armstrong and others, 1970.)
Walker Formation of Wilhelm and Saunders (1927) adopted. Underlies Vedder Sand, when present, or Jewett Sand. (Addicott, 1970.)
Wallace Creek Tongue of Barwin (1961) adopted as upper member of Cody Shale in southeastern Wind River basin. Separated from main body of Cody by Fales Sandstone Member of Mesaverde Formation. (Gill and others, 1970.)
Waltersburg Formation/Sandstone reduced in rank to member of Buffalo Wallow Formation in north-central Kentucky. Remains of formation rank in Illinois and western Kentucky. (Goudarzi, 1970.)
In Fossil basin, Wasatch Formation is divided into seven units: basal conglomerate member, lower member, main body, sandstone tongue, mudstone tongue, Bullpen Member (new), and peripheral Tunp Member (new), which is equivalent to parts of upper five units. (Oriel and Tracey, 1970.)
West Canyon Limestone Member of Nygreen (1958) adopted and redefined as lowermost of three formations in Oquirrh Group in Bingham sequence (central and southern Oquirrh Mountains). Underlies Butterfield Peaks Formation (new). (Tooker and Roberts, 1970.)
Age changed from Oligocene or older to Oligocene and older(?). (Lipman and others, 1970.)
Whitehead Granite abandoned. Its rocks included in Irving, Twilight, or Tenmile Formation, depending on location. (Barker, 1969.)
Age changed from Early Mississippian to Early Permian to Late Mississippian. (Skipp and Mamet, 1970.)
Name changed from White Mountain Plutonic-Volcanic Series to White Mountain Plutonic Series. (Cady, 1969.)
Age changed from Ordovician to Devonian to Precambrian(?). (Bryant and Reed, 1970.)
Age changed from Mississippian to Early Mississippian. (Kinderhook and Osage). (McKee and Gutschick, 1969.)
Wilcox Group in central Mississippi divided into Hatchetigbee, Tuscahoma, and Nanafalia Formations. (Cushing and others, 1970.)

Name	Age	Location
Wood Canyon Formation	Precambrian and Early Cambrian.	Southeastern California and southern Nevada.
Yampa Limestone Lentil (of Bingham Quartzite).	Pennsylvanian _____	North-central Utah ___
Zabriskie Quartzite ____	Early Cambrian _____	Southeastern California and southern Nevada.
Zimmer Ridge Member (of Oreville Formation).	Precambrian _____	South Dakota _____

THE MIFFLINTOWN FORMATION OF MIDDLE SILURIAN AGE, BEDFORD COUNTY, PENNSYLVANIA

By Wallace de Witt, Jr.

Miller and Conlin (in Miller, 1961, p. 11) redefined the Mifflintown Limestone of Lesley (in Dewees, 1878, p. xxv–xxvi) to include the strata between the top of the Rose Hill Formation and the base of the Bloomsburg Red Beds in the Loysville quadrangle, Juniata and Perry Counties, Pa. They designated the Mifflintown a formation and recognized two mappable units: the Keefer Member overlain by the undivided Rochester and McKenzie Members.

Recent geologic mapping in the vicinity of Hyndman and Beans Cove in southwest Bedford County, Pa., demonstrated that the Mifflintown can be mapped in this area, and the formation as redefined by Miller and Conlin is herein adopted for use by the U.S. Geological Survey. The Mifflintown consists of 300–425 feet of soft calcareous shale, intercalated with thin-bedded lenticular fossiliferous limestone, and a small amount of sandstone, siltstone, and sandy hematite in the basal part. The formation is one of the least well exposed units in southwest Bedford County, and generally only the more resistant sandy beds of the basal Keefer Member as used by Miller and Conlin are exposed.

The twofold subdivision of the Mifflintown can be recognized; however, the basal Keefer is commonly too thin to be mapped at a scale of 1:24,000. Locally, in the northwest part of Beans Cove, the Keefer is as much as 25 feet thick, but generally it is about 10 feet thick. Because the Keefer is composed of resistant sandstone, siltstone, and silty mud rock, the unit commonly holds up a line of

Revision and reference
Wood Canyon Formation extended to all rocks previously designated Daylight Formation. Also extended to Kingston Range and Clark Mountain area, California, at expense of Prospect Mountain Quartzite. As thus defined, generally overlies Stirling Quartzite and everywhere underlies Zabriskie Quartzite. (Stewart, 1970.)
Yampa Limstone Lentil abandoned. Its rocks included in Bingham Mine Formation. (Tooker and Roberts, 1970.)
Zabriskie Quartzite extended into Kingston Range, Clark Mountain area, and Providence Mountains. Everywhere overlies Wood Canyon Formation and underlies Carrara Formation. Includes all rocks previously designated Corkscrew Quartzite. (Stewart, 1970.)
Zimmer Ridge Member adopted. (Ratte and Wayland, 1969.)

small knobs that rise as much as 40–80 feet topographically above the less resistant and more calcareous part of the steeply dipping Mifflintown.

In southern Bedford County, as in adjacent Allegany County, Md., the intercalated shale and thin-bedded limestone of the Rochester are lithologically indistinguishable from much of the overlying McKenzie (de Witt and Colton, 1964, p. 17). The two units can only be differentiated by their contained faunas. Meager paleontologic data suggest that the Rochester Member as used by Miller and Conlin may be as much as 35 feet thick in southwest Bedford County but is generally too thin to be mapped as a separate unit at a scale of 1:24,000. In contrast, the McKenzie Member as used by Miller and Conlin is more than 300 feet thick.

The base of the Mifflintown Formation, the lower boundary of the Keefer unit, is marked in southwest Bedford County by an abrupt change from medium-olive-gray silty shale of the underlying Rose Hill Formation to olive-gray calcareous siltstone, lenticular sandy hematite, and light-gray quartzitic sandstone. The top of the Keefer unit is generally covered by float and is rarely observed except in artificial exposures. The McKenzie unit of the Mifflintown is gradational into the overlying Bloomsburg Red Beds in a 10- to 15-foot zone of intercalated thin-bedded dark-gray lenticular limestone, olive-gray calcareous shale, light-greenish-gray silty shale, and grayish-red to purple silty mud rock. The boundary between the two formations is commonly placed at the base of a massive purple silty mud rock in the upper part of the transitional sequence. The boundary is generally marked by an abrupt change in soil color in cultivated fields and by an abundance of chips of reddish-brown and purple silty mud rock in wooded areas.

NEW AGE ASSIGNMENTS IN THE STRATIGRAPHY OF THE GLASS MOUNTAINS, WESTERN TEXAS

By G. A. Cooper[1] and R. E. Grant

Based on the preponderance of brachiopod evidence, the following new assignments are made in the stratigraphy of the Glass Mountains, western Texas: The upper part of the Gaptank Formais is placed in the Wolfcamp Series as is the Skinner Ranch Formation. These assignments are based on early spasmodic presence of such Permian elements as *Limbella* (an aulostegid brachiopod), *Scacchinella* (a well-known Permian type), and *Waagenoconcha* in rocks formerly considered Late Pennsylvanian. These three and other Permian types became increasingly abundant in the famous Uddenites-bearing shale member of the Gaptank Formation, here placed at the bottom of the Permian. Many Pennsylvanian and Wolfcamp genera and the great biohermal assemblages of the Wolfcamp rocks culminated in the Skinner Ranch Formation, which represents the end of the Wolfcamp Series.

Faunas of the Road Canyon Formation have already been assigned to the Leonard Series by Cooper and Grant (1966), who regarded the preponderance of the fauna to be Leonard in generic content and general expression. Higher Word Formation assemblages are correlated with the Guadalupe type area as follows: Fossils of the China Tank Member (formerly Second Limestone Member) appear in the Cherry Canyon Formation; lower Getaway Limestone Member of the Cherry Canyon has the fauna of the Willis Ranch Member (Third Limestone Member of the Word of P. B. King); and upper Gateway contains fossils of the Appel Ranch Member (Fourth Limestone Member of the Word). The South Wells Member of the Cherry Canyon, a black shale and carbonate facies, seems not to be represented in the Glass Mountains. Bell Canyon Formation (Hegler Limestone Member) fossils have been found in undolomitized limestone at the base of the Capitan Limestone in the Glass Mountains.

Although these changes are based largely on brachiopods, they are in accordance with age indications of some other groups but not all.

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